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Wildlife Research Report

The *Wildlife Research Report* series contains reports and specialized bibliographies relating to birds, mammals, and other wildlife and their ecology. Intended audiences are research scientists and technically trained management personnel. Subjects include scientific and technical papers based on original wildlife research, and may include literature reviews. Publications are typeset and have a standard size of 18 × 25 cm (6 7/8 × 9 7/8 in.); length varies. This is a continuation of the *Research Report* series which was established in 1941 by consolidating the *Wildlife Research Bulletins* (which had been established in 1939 by the former Bureau of Biological Survey, which in turn superseded *Biological Survey Bulletins* established in 1885, *Department of Agriculture Bulletins* established in 1913, and the *Technical Bulletins* established in 1927). *Wildlife Research Report* series was first issued in 1972. In 1985 it was combined with *Research Report* and renamed *Fish and Wildlife Research*.

1. HENNY, C. J. 1972. An analysis of the population dynamics of selected avian species. With special reference to changes during the modern pesticide era. 99 pp.
Impact of pesticides on mortality and recruitment rates for 16 nongame bird species; more than 25 years was evaluated. A mathematical model of the relations between population parameters yielding stable populations was developed. Variables in the model are: 1) mortality rate schedule, 2) recruitment rates, and 3) the age of sexual maturity. Population parameters were compared to determine whether changes had occurred between periods. Species subjected to analysis were great horned owl (*Bubo virginianus*), red-shouldered hawk (*Buteo lineatus*), American kestrel (*Falco sparverius*), osprey (*Pandion haliaetus*), common barn-owl (*Tyto alba*), Cooper's hawk (*Accipiter cooperii*), red-tailed hawk (*Buteo jamaicensis*), great blue heron (*Ardea herodias*), black-crowned night-heron (*Nycticorax nycticorax*), brown pelican (*Pelecanus occidentalis*), barn swallow (*Hirundo rustica*), chimney swift (*Chaetura pelagica*), blue jay (*Cyanocitta cristata*), black-capped chickadee (*Parus atricapillus*), northern cardinal (*Cardinalis cardinalis*), and American robin (*Turdus migratorius*).
2. SMITH, R. I., J. R. PALMER, AND T. S. BASKETT, EDITORS. 1972. Population ecology of migratory birds. Papers from a symposium held at the Migratory Bird Populations Station, Laurel, Maryland, 9-10 October 1969. Sponsored by the American Institute of Biological Sciences in cooperation with the Bureau of Sport Fisheries and Wildlife, U.S. Department of the Interior. 278 pp.
Papers presented include 1) Mallard migration corridors as revealed by population distribution, banding, and radar; 2) The relevance of the mapping census technique to the conservation of migratory bird populations; 3) Population ecology of the Australian black-billed magpie (*Pica pica*), royal penguin (*Eudyptes schlegeli*), and silver gull (*Larus novaehollandiae*) in Australia; 4) Influence of territory on structure and dynamics of bird populations; 5) Aspects of mallard breeding ecology in Canadian parkland and grassland; 6) Some problems in estimating survival from banding data; 7) The importance of movements in the biology of herring gulls in New England; 8) Role of banding data in migratory bird population studies; 9) Population ecology and environmental pollution: red-tailed (*Buteo jamaicensis*) and Cooper's (*Accipiter cooperii*) hawks; 10) British studies of goose populations: hindsight as an aid to foresight; and 11) Population ecology of migratory birds: symposium summary.
3. BOGAN, M. A. 1975. Geographic variation in *Myotis californicus* in the southwestern United States and Mexico. 31 pp.
Geographic variation in the California bat (*Myotis californicus*) in the southwestern United States and Mexico was analyzed by univariate and multivariate statistical procedures. Variation in bats in the study area is explained by isolation of populations during pluvial times. No revisions in nomenclature seemed necessary. Different phenetic groups, pelage color variation, and sexual dimorphism are discussed.
4. HUSAR, S. L. 1975. A review of the literature of the dugong (*Dugong dugon*). 30 pp.
5. STATON, M. A., AND J. R. DIXON. 1977. Breeding biology of the spectacled caiman, *Caiman crocodilus crocodilus*, in the Venezuelan Llanos. 21 pp.

Breeding biology of the spectacled caiman (*Caiman Crocodilus crocodilus*) in the Venezuelan Llanos was studied during the latter part of the 1973 breeding season and the beginning of the 1974 season. Courtship, copulation, nesting, nest care, hatching, and postnatal care are discussed. Data include clutch size, egg measurements, internal nest temperatures and relative humidity, incubation period, and hatchling measurements.

6. JOHNSON, D. H., AND A. B. SARGEANT. 1977. Impact of red fox predation on the sex ratio of prairie mallards. 56 pp.

The role that red fox (*Vulpes vulpes*) predation may play in causing unbalanced sex ratios among dabbling ducks was examined. A simple model of mallard (*Anas platyrhynchos*) population dynamics, as affected by fox predation, hunting, and other mortality, was developed for the prairie pothole region of North Dakota during 1963-73. Validity of the model is assessed mathematically and by comparison with field studies.

7. HUSAR, S. L. 1977. The West Indian manatee (*Trichechus manatus*). 22 pp.

The life history of the West Indian manatee (*Trichechus manatus*) is presented. Exploitation, legislation, protection, and conservation of the manatee are also discussed.

8. BURY, R. B., R. A. LUCKENBACH, AND S. D. BUSACK. 1977. Effects of off-road vehicles on vertebrates in the California desert. 23 pp.

The effects of off-road vehicles on numbers of species, abundance, biomass, diversity, and density of vertebrates in creosote shrub habitat in eastern California was investigated. Changes in the vertebrate community resulting from off-road vehicle use are documented.

9. OHLENDORF, H. M., R. W. RISEBROUGH, AND K. VERMEER. 1978. Exposure of marine birds to environmental pollutants. 40 pp.

Investigations of the effects of environmental pollutants on marine birds are reviewed. Petroleum hydrocarbons are described, and their sources in U.S. waters as well as their transfer and dissipation in marine environments are discussed. Other pollutants described include organochlorines, heavy metals, plastic, rubber, and refuse. Biological effects of exposure of marine birds to each pollutant are described. Recommendations for future investigations are suggested.

10. REEVES, R. R. 1978. Atlantic walrus (*Odobenus rosmarus rosmarus*): a literature survey and status report. 41 pp.

A literature survey of the Atlantic walrus (*Odobenus rosmarus rosmarus*), including information about the biology, ecology, exploitation, and

status of the walrus. Management practices to increase walrus populations are suggested.

11. BARTONEK, J. C., AND D. N. NETTLESHIP, EDITORS. 1979. Conservation of marine birds of northern North America. Papers from the international symposium held at the Seattle Hyatt House, Seattle, Washington, 13-15 May 1975. 319 pp.

Includes papers presented on the following subjects: 1) status of marine bird populations, 2) biology and ecology of marine birds in the North, 3) conflicts between conservation of marine birds and uses of other resources, 4) programs and authorities related to marine bird conservation, and 5) conservation of marine birds in other lands.

12. BURY, R. B., EDITOR. 1982. North American tortoises: conservation and ecology. In cooperation with the World Wildlife Fund. vii + 126 pp.

A synthesis of information is presented on the status of the four species of tortoises endemic to North America, desert tortoise (*Gopherus agassizii*), Berlandier's tortoise (*G. berlandieri*), gopher tortoise (*G. polyphemus*), and Bolson tortoise (*G. flavomarginatus*). Factors reducing populations of tortoises are described and principal corrective actions are suggested.

13. SCOTT, N. J., JR., EDITOR. 1982. Herpetological communities. A symposium of the Society for the Study of Amphibians and Reptiles and the Herpetologists' League, August 1977. iv + 239 pp.

Two review papers are followed by eight studies of amphibian, snake, and lizard communities, four studies of entire assemblages from tropical and sandy soil habitats, and three papers dealing with field techniques for the study of herpetofaunal communities. Final paper gives historical resume of herpetological community studies, a summary of papers in the volume, and recommendations for the future.

14. DWYER, T. J., AND G. L. STORM, TECHNICAL COORDINATORS. 1982. Woodcock ecology and management. Papers from the Seventh Woodcock Symposium held at the Pennsylvania State University, University Park, 28-30 October 1980. 191 pp.

Papers given discuss techniques of woodcock management such as singing-ground surveys, population inferences, visual and audio identification, and sex and age determination. Ecology subject matter includes nest sites, brooding, breeding, movement, home range, and reproductive activity indicators. Also examined are land use and habitat management and history of the woodcock.

15. KANTRUD, H. A., AND R. L. KOLOGISKI. 1982. Effects of soils and grazing on breeding birds of uncultivated upland grasslands of the northern Great Plains. 33 pp.

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Effects of grazing on various birds of the Great Plains grasslands were measured using bird censuses and plant surveys during 1974-78 on lightly, moderately, and heavily grazed native rangeland plots. Bird species evaluated were: horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), lark bunting (*Calamospiza melanocorys*), and chestnut-collared longspur

(*Calcarius ornatus*). Parameters investigated were composition of dominant species, species richness, and density. Variables affecting the parameters were soil type, temperature, moisture, and organic matter content, as well as grazing. Dominant plants were *Agropyron* spp. and *Bouteloua gracilis*. Optimum habitat for each bird species is described in terms of grazing, soils, and dominant plant species.

Research Report

The *Research Report* series contains scientific and technical papers about original fishery research. Publications are typeset and have a standard size of 18 × 25 cm (6 7/8 × 9 7/8 in.); length varies. Intended audiences are research scientists and technically trained management personnel. This series supersedes *Investigational Report* of the Bureau of Sport Fisheries and *Wildlife Research Bulletin* of the Bureau of Biological Survey, both initiated in 1920. These series were discontinued in 1940 when the Bureaus merged to form the Fish and Wildlife Service. First issued in 1941, the *Research Report* series was combined with the *Wildlife Research Report* series in 1985 and renamed *Fish and Wildlife Research*.

1. STANSBY, M. E., AND J. M. LEMON. 1941. Studies on the handling of fresh mackerel (*Scomber scombrus*). 46 pp.
Discusses results of mackerel (*Scomber scombrus*) studies conducted as a basis for recommendations leading to increased distribution and popularity of mackerel. Includes discussion on improved handling methods, fat content, storage, and marketing.
2. LOOSANOFF, V. L., AND J. B. ENGLE. 1942. Use of lime in controlling starfish. 29 pp.
Describes methods and effects of lime on starfish (*Asterias forbesi*). Presents and discusses results of eradication experiments and examines effects of lime on other animals. Makes management recommendations.
3. LANHAM, W. B., JR., AND H. W. NILSON. 1942. The effect of heat and moisture on the feeding value of pilchard meal. 10 pp.
Reports and discusses results of experiments in which rats and chicks were fed purified diets incorporating pilchard meal. The effects of increased heat and high humidity on the nutritive value of the meal were examined.
4. NILSON, H. W., AND J. M. LEMON. 1942. Metabolism studies with algin and gelatin. 9 pp.
Studies were conducted on male rats over a period of 10 weeks to determine nutritive effects of vegetable gum of algin and protein of gelatin.
5. ALDOUS, S. E. 1942. The white-necked raven in relation to agriculture. 56 pp.
Presents results of a 5-year study of white-necked raven chihuahuan (formerly white-necked) (*Corvus cryptoleucus*) activities and food habits. Contents of 827 stomachs were analyzed. Includes data on life history, damage, economic status, and crop protection.
6. STANSBY, M. E., AND F. P. GRIFFITHS. 1943. Preparation and keeping quality of lightly smoked mackerel. 10 pp.
Describes preparation, sampling procedure, and changes during preparation of smoked mackerel (*Scomber scombrus*). Discusses storage and factors influencing rancidity.
7. JARVIS, N. D. 1943. Principles and methods in the canning of fishery products. 366 pp.
Discusses scientific principles on which canning is based, outlines various engineering problems faced by the canner, and gives a detailed description of current methods used in the commercial canning of 58 varieties of fish and shellfish packed commercially in hermetically sealed containers. Information on spoilage and methods used in the examination of fishery products is provided.
8. JACKSON, H. T. 1944. Big game resources of the United States 1937-1942. 56 pp.
Discusses big game estimates and counts and provides 1941 big game inventory. Presents population trends in principal big game species and on different land-classification areas. Gives game kill data.
9. ELLIS, M. M., B. A. WESTFALL, AND M. D. ELLIS. 1946. Determination of water quality. 122 pp.
Methods are presented for the determination of those characteristics of natural waters that are of major importance to aquatic biologists in connection with fisheries problems. Both unpolluted and polluted waters have been considered, and procedures for the evaluation of pollution hazards outlined. Usually more than one method for each type of determination is offered to meet the different degrees of accuracy required in several types of studies.
10. PALMER, L. J., AND C. H. ROUSE. 1946. Study of the Alaska tundra with reference to its reactions to reindeer and other grazing. 48 pp.
Lists tundra plants and describes vegetation types and their reactions to cutting and denuding treatments. Suggests management techniques for caribou (formerly reindeer) (*Rangifer tarandus*).

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11. GALTSOFF, P. S. 1946. Reaction of oysters to chlorination. 28 pp.
Reaction of oysters to free chlorine was studied by recording shell movement, measuring the rate of flow of water through the gills, and determining the beat frequency of the lateral cilia of the gills.
12. DAVIS, H. S. 1946. Care and diseases of trout. 98 pp.
Discusses the care of trout, including the care of ponds and raceways, feeding methods, and foods—especially the use of dry products for supplementing fresh meat in the diet. Mentions improvement of brood stock, parasites, and diseases. Describes each disease, including symptoms, etiology, pathology, and control methods.
13. PEARCE, J. 1947. Identifying injury by wildlife to trees and shrubs in northeastern forests. 29 pp.
Discusses injury by rodents, browsing animals, black bears (*Ursus americanus*), birds, and wildcats. Briefly describes chewing tags, gnawing around den entrances, gnawing stakes, and tree flooding by beavers (*Castor canadensis*).
14. PEARSON, J. C. 1948. Fluctuations in the abundance of the blue crab in Chesapeake Bay. 26 pp.
Analyzes catch per unit of fishing effort of blue crabs (*Callinectes sapidus*) and correlates abundance data with variable survival rates in the first year of life and volume of discharge from James and Potomac rivers. Relative abundance of female adults and their progeny was studied, as was the influence of spawning stock size on population size surviving to commercial age.
15. WARFEL, H. E., AND J. A. CLAGUE. 1950. Shark fishing potentialities of the Philippine Seas. 19 pp.
Exploratory fishing with longlines and gill nets was done to determine potential value of sharks. Describes region, fishing gear, and operational factors. Discusses production results, vitamin A and oil content of livers, and shark by-product possibilities such as oil, hides, fins, meat, and teeth.
16. KAUFFMAN, D. E. 1950. Notes on the biology of the tiger shark (*Galeocerdo arcticus*) from Philippine waters. 10 pp.
Data on 43 tiger sharks (*Galeocerdo arcticus*) taken on longline trawls in Philippine waters are presented. Adult sharks and unborn pups are described, weight-length and body-weight to liver-weight relations are summarized, and fecundity and size at sexual maturity are discussed. Food habits are also discussed.
17. UMALI, A. F. 1950. Guide to the classification of fishing gear in the Philippines. 165 pp.
Contains: 1) basic classification of fishing gear, 2) key for fishing gear identification and classification of new gear, 3) definitions and illustrations of gear, 4) tabular classification of local Filipino dialect names, and 5) glossary.
18. JARVIS, N. D. 1951. Curing of fishery products. 271 pp.
Includes information from recent technical studies of the principles on which fish curing is based, discusses improvements in methods and equipment, and describes standard methods.
19. BOURN, W. S., AND C. COTTAM. 1951. Some biological effects of ditching tidewater marshes. 30 pp.
Presents and discusses results of studies conducted over a 12-year period, 1935–47, of the biological effects of ditching tidewater marshes in Delaware for mosquito control. Describes effects on floral cover and invertebrates.
20. HERRE, A. W. 1953. Checklist of Philippine fishes. 977 pp.
21. UMALI, A. F. 1951. Key to the families of common commercial fishes in the Philippines. 47 pp.
22. CLAGUE, J. A., AND B. DATINGALING. 1951. Fishing gear preservation for Philippine waters. 23 pp.
23. HAMM, W. S. 1951. Liver oil properties of Philippine sharks and rays. 5 pp.
Presents and discusses results of assays of shark and ray livers for vitamin A. Other physical and chemical properties of shark oils were noted.
24. HAMM, W. S., AND J. A. CLAGUE. 1951. Temperature and salt purity effects on the manufacture of fish paste and sauce. 11 pp.
25. WARFEL, H. E., AND P. R. MANACOP. 1951. Otter trawl explorations in Philippine waters. 49 pp.
Presents and discusses results of surveys of 24 areas using an otter trawl. Includes composition of catch and catch by depth data.
26. AVERY, A. C. 1951. Fish processing handbook for the Philippines. 149 pp.
Covers the handling of fresh fish, various methods of preserving fish—freezing, salting, drying, smoking, canning, and miscellaneous methods such as pickling, and spoilage of fish and fish products. Gives a step-by-step description of Philippine fish-preserving methods with suggestions on improving them, and of methods used in other parts of the world which have been adapted for Philippine use.
27. CLAGUE, J. A., AND C. ALMARIO. 1951. Bacteriological studies of Philippine fishing products. 12 pp.
To obtain information on the bacteriological quality of Philippine fishery products, tests were made on

- oysters and overlying waters from oyster farms, and on fresh and processed fish and shellfish from Manila markets. Recommendations are presented for improving the bacteriological quality of fishery products.
28. WARFEL, H. E. 1951. Outlook for development of a tuna industry in the Philippines. 37 pp.
Results of 2.5 years of study and exploration of this resource and the prospects for developing it are presented. Describes Philippine tuna species and their distribution.
 29. SCHAEFER, M. B., O. E. SETTE, AND J. C. MARR. 1951. Growth of Pacific Coast pilchard fishery to 1942. 31 pp.
Describes history, growth, and fluctuations related to economic cycles of the fishery. Describes legal regulations in British Columbia, Oregon, Washington, and California.
 30. MARTIN, A. C., AND F. M. UHLER. 1951. Food of game ducks in the United States and Canada. 308 pp.
Presents statistical index to preferred duck foods in various regions of the United States and Canada, based on analyses of nearly 8,000 stomachs or gullets of 18 duck species. Provides descriptions, illustrations, and distribution maps for 200 principal food items. Includes suggestions on propagation of waterfowl foods and development of feeding grounds. Discusses principles related to producing duck foods.
 31. BUTLER, P. A. 1952. Effect of floodwaters on oysters in Mississippi Sound in 1950. 20 pp.
Discusses the biological and hydrographic data collected during the flood period in 1950. Includes data on flood effects on salinity, water transparency, hydrogen-ion concentration, oysters, associated animals, and plankton collections.
 32. SCHUCK, H. A. 1952. Offshore grounds important to the United States haddock fishery. 20 pp.
Presents information concerning areas fished for haddock by the United States otter-trawl fleet over a 12-year period, 1938-49. A series of charts is included, showing the relative intensity of fishing over areas fished for the entire study period, and the relative intensities in each month of the year.
 33. LEHMAN, B. A. 1953. Fecundity of Hudson River shad. 8 pp.
Describes American shad (*Alosa sapidissima*) ovaries and ova counts collected from the Hudson River in April 1951. Relates fecundity with length, weight, and age.
 34. JUNE, F. C., AND J. W. REINTJES. 1953. Common tuna-bait fishes of the central Pacific. 54 pp.
Designed for practical field identification of the more common tuna-bait fishes in the central Pacific. Presented are illustrated keys to families and species, with descriptions and notes on distribution, and an evaluation of tuna-bait resources of the central Pacific region with a description of each potentially important baiting area. Provides index of scientific, English, Hawaiian, and Gilbertese names of fishes.
 35. JOHNSON, H. E., AND R. F. BRICE. 1953. Use of impounded water for fish culture. 35 pp.
Water analyses and hatchery experiments were conducted from 1950-52 to determine the suitability of impounded water for fish culture. Hatchery experiments were with chinook salmon (*Oncorhynchus tshawytscha*), silver (coho) salmon (*O. kisutch*), rainbow trout (*Salmo gairdneri*), and cutthroat trout (*S. clarki*).
 36. FISH, C. J., AND M. C. COBB. 1954. Noxious marine animals of the central and western Pacific Ocean. 45 pp.
Describes invertebrates, elasmobranchs, teleosts, and reptiles and their potential hazards to humans.
 37. MOSHER, K. H., AND H. H. ECKLES. 1954. Age determination of Pacific sardines from otoliths. 40 pp.
Otoliths and scales taken from some 500 sardines of the December 1942 San Francisco fishery were read to ascertain if the age of adult sardines can be determined from otoliths. This method was then used to determine the age composition of sardine (*Sardinops caerulea*) populations for 1932-38 with otoliths from samples of commercial catch. Data are also given for the number of sardines landed in the years covered by this study, their age composition, length composition, year-class strength, and survival.
 38. WALBURG, C. H. 1955. Relative abundance of Maryland shad. 17 pp.
Catch and effort data for American shad (*Alosa sapidissima*) during 1944-52 were used in conjunction with a tagging experiment, to estimate fishing effort, fishing rate, catch, size of run, and spawning escapement for each year.
 39. BURROWS, R. E., AND H. H. CHENOWETH. 1955. Evaluation of three types of fish rearing ponds. 29 pp.
Hydraulic investigations were conducted on three types of fish-rearing ponds: the Foster-Lucas, circular, and raceway. Models constructed on 1:10 scale effectively reproduced the hydraulic conditions found in the prototypes. Flow patterns were observed by means of floats and dyes. The degree of short circuiting, mixing, apparent detention time, and probable flowing-through time were

determined by means of dye injection in the water inflow and measurements of the time of appearance and concentration of the dye at the outflow. The four major criteria used to establish pond efficiency were carrying capacity, disease inhibition, food distribution, and facility of cleaning.

40. NELSON, P. R., AND C. E. ABEGGLEN. 1955. Survival and spawning of gill-net-marked red salmon. 19 pp.

On Kodiak Island in Karluk Lagoon, 6,253 salmon were tagged in 1953 to determine the effect of gill-net marks on survival and spawning. Approximately half of these fish were gill-net marked and the remainder were unmarked (control) fish. Number tags of several color combinations were used so observations could be made on each group of fish both enroute to and on the spawning grounds.

41. STOLTING, W. H., M. J. GARFIELD, AND D. R. ALEXANDER. 1955. Fish and shellfish preferences of household consumers. 115 pp.

Provides results of a nationwide survey in October 1951 of household consumers' preferences for fresh and frozen fishery products.

42. VAN OOSTEN, J., AND P. H. ESCHMEYER. 1956. Biology of young lake trout (*Salvelinus namaycush*) in Lake Michigan. 88 pp.

Experimental fishing with gill nets of five mesh sizes (range, 2 3/8 to 3 in.) in Lake Michigan in 1930-32 yielded more than 16,000 young lake trout. Data are presented on age, growth, length-weight relations, abundance, geographical and bathymetric distribution, sex ratios, and species composition of associates of young lake trout.

43. RAYMOND, H. L. 1956. Effect of pulse frequency and duration in guiding salmon fingerlings by electricity. 19 pp.

The relation of pulse frequency and pulse duration to the effectiveness of a moving field of pulsating direct current in directing Pacific salmon fingerlings was explored under controlled laboratory conditions, using a single-row electrode array.

44. PARKER, P. S., AND R. E. LENNON. 1956. Biology of the sea lamprey in its parasitic phase. 32 pp.

Observations on lampreys (*Petromyzon marinus*) reared from metamorphosis to maturity were made at Hammond Bay, Michigan. Investigations were conducted on duration of parasitic phase of life, feeding, growth, and interrelations between predator and host fish.

45. LEE, C. F. 1956. Preparation of a dry product from condensed menhaden solubles. 33 pp.

Dried solubles were prepared with a small drum dryer from 32 samples of typical condensed

menhaden (*Brevoortia*) solubles obtained from plants along the coasts of the Middle and South Atlantic and the Gulf of Mexico. Chemical and physical properties were determined for both the condensed solubles and the resultant dry products. These dry products can be included in mixed farm animal feeds.

46. SYKES, J. E., AND B. A. LEHMAN. 1957. Past and present Delaware River shad fishery and considerations for its future. 25 pp.

Describes the Delaware River and provides a history of the American shad (*Alosa sapidissima*) fishery. Discusses the distribution and migration of adult and juvenile shad, and the influence of pollution on shad abundance.

47. COPE, O. B., AND D. W. SLATER. 1957. Role of Coleman Hatchery in maintaining a king salmon run. 22 pp.

Reports on studies at Coleman Hatchery, California, to determine how many king salmon (*Oncorhynchus tshawytscha*) entering the fisheries were released from the hatchery, and whether spring or fall immature salmon releases were more effective. Fish were captured and marked; commercial and sport catches were then examined for marked fish.

48. WALBURG, C. H., AND J. E. SYKES. 1957. Shad fishery of Chesapeake Bay with special emphasis on the fishery of Virginia. 26 pp.

A study of American shad (*Alosa sapidissima*) in Chesapeake Bay was made in 1952. Catch and effort records were combined with data obtained from tagging studies conducted at the entrance to Chesapeake Bay, in the James and Potomac rivers, and at Cove Point, Maryland, to obtain population parameters for these areas. Total population and escapement were determined for the Potomac River for each year from 1944-51 in which these data were available.

49. DAVIS, W. S. 1957. Ova production of American shad in Atlantic Coast rivers. 5 pp.

Ova production of American shad (*Alosa sapidissima*) was estimated on the basis of samples of five fish from each of six Atlantic Coast rivers. Ova counts were compared by location of sample.

50. WISE, J. P. 1957. Growth rate of Browns Bank haddock. 13 pp.

Presents and discusses the results of a study of the growth rate of haddock (*Melanogrammus aeglefinus*), in which back-calculations were made from scales taken from fish ranging in age from 4 to 10 years.

51. HILE, R., AND H. J. BUETTNER. 1959. Fluctuations in the commercial fisheries of Saginaw Bay, 1885-1956. 38 pp.

- Discusses total commercial production, yearly maximum and minimum catches, actual and percentage contributions of individual species to total catch, and major years of production. Interrelations of production, availability, and fishing intensity in 1929-56 are described for eight principal species. Mentions future outlook of fishery and makes recommendations.
52. VAN CAMPEN, W. G. 1960. Japanese summer fishery for albacore (*Germo alalunga*). 29 pp.
The albacore fishery carried on by a fleet of Japanese live-bait tuna boats in spring and early summer in the northwestern Pacific is described. A historical account is given of the fishery. The magnitude of its production is compared with other Japanese albacore fisheries and with the United States west coast fishery. Seasonal trends in landings, geographical distribution of bases and fishing grounds, and marketing and use of the catch are discussed.
 53. WOLF, R. S. 1961. Age composition of the Pacific sardine 1932-1960. 35 pp.
Estimates of the age composition of commercial landings of Pacific sardine (*Sardinops caerulea*) at Monterey and San Pedro for the seasons 1938-39, 1939-40, and 1940-41 are given. A mode-subtraction method was used to make estimates for the 1938-39 season and its accuracy is discussed. Estimates for the other seasons were obtained by applying the age data collected during those seasons. All known age-composition data for the Pacific sardine for the seasons 1932-33 through 1959-60 are presented. Estimates of year-class size in numbers of fish are given by season and port of landing.
 54. BULKLEY, R. V. 1961. Fluctuations in age composition and growth rate of cutthroat trout in Yellowstone Lake. 31 pp.
Age composition, growth rate, and year-class strength of Yellowstone Lake cutthroat trout (*Salmo clarki lewisi*) from collections made in 1948 and from 1950 to 1959 are analyzed to relate total catch to changes in age composition and growth rate.
 55. BALL, O. P., AND O. B. COPE. 1961. Mortality studies on cutthroat trout in Yellowstone Lake. 62 pp.
In a study of Yellowstone Lake cutthroat trout (*Salmo clarki lewisi*), effects of environment on mortality of eggs, immature fish, spawners, and post-spawners were measured for various components of the population in Yellowstone Lake (Wyoming). Five methods for estimating mortality of adults on spawning runs are described, with counting and tagging as the principal procedures. Migrations of adult fish in Yellowstone Lake were traced through tagging.
 56. BENSON, N. G. 1961. Limnology of Yellowstone Lake in relation to the cutthroat trout. 33 pp.
Limnological data collected from 1954 to 1959 on surface currents, bottom currents, temperatures, bottom soils, water chemistry, plankton, bottom fauna, and higher aquatic plants are related to the biology of the Yellowstone Lake cutthroat trout (*Salmo clarki lewisi*) in Yellowstone Lake (Wyoming).
 57. SHELL, E. W. 1961. Chemical composition of blood of smallmouth bass. 36 pp.
Concentrations of 16 organic and inorganic components of the blood and serum of smallmouth bass (*Micropterus dolomieu*) were measured every 3 to 4 weeks from 24 June to 18 November 1958. Components measured included proteins, nonprotein nitrogen fractions, phosphorus fractions, electrolytes, and cholesterol in serum; and glucose, creatinine, and iron in blood. A scheme of hormone-homone antagonism is proposed to account for the cyclic nature of the concentration curves.
 58. MOUNT, D. I. 1962. Chronic effects of endrin on bluntnose minnows and guppies. 38 pp.
Lethal and sublethal concentrations of endrin were determined for bluntnose minnows (*Pimephales notatus*) and guppies (*Poecilia reticulata*). The signs described indicated that endrin affected the central nervous system. The 96-hour TL_m values were determined for different sizes of fish by continuous-flow acute-toxicity tests. The effects of endrin on oxygen consumption were noted, and endrin concentrations in common carp (*Cyprinus carpio*) tissues were studied.
 59. BULKLEY, R. V., AND N. G. BENSON. 1962. Predicting year-class abundance of Yellowstone Lake cutthroat trout. 21 pp.
Fluctuations in strength of year classes from 1945 to 1956 of Yellowstone Lake cutthroat trout (*Salmo clarki lewisi*) from Pelican and Chipmunk Creeks are compared with parental stock and several climatically influenced factors of the environment, including water levels and air temperatures. A formula based on water levels is presented for predicting year-class strength in Pelican Creek and in the Fishing Bridge area fishery. A method of forecasting lake water levels several months in advance of their occurrence is discussed.
 60. MACIOLEK, J. A. 1962. Limnological organic analyses by quantitative dichromate oxidation. 61 pp.
A limnological oxidation technique, based on procedures employed in soil chemistry, was developed and tested by use of purified organic compounds and various natural substrates. The technique is described and evaluated.

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61. CLEMENS, H. P., AND K. E. SNEED. 1962. Bioassay and use of pituitary materials to spawn warm-water fishes. 30 pp.
- By bioassay, evaluation was made of the activity and relative potency of pituitaries collected throughout the year from various species of fish. Goldfish, zebra fish, and channel catfish were the chief test species; carp, green sunfish, largemouth bass, white crappie, and flathead catfish were used occasionally. Positive response was indicated by ovulation of eggs or by increase in seminal plasma.
62. BENSON, N. G., AND R. V. BULKLEY. 1963. Equilibrium yield and management of cutthroat trout in Yellowstone Lake. 44 pp.
- Equilibrium yield of Yellowstone Lake cutthroat trout, *Salmo clarki lewisi*, in Yellowstone Lake, Wyoming, is determined from data on catch and spawning runs from 1945 to 1961. Changes in growth rate, spawning runs, mortality rates, and year-class strength are related to differences in total catch. Three stages of exploitation of the stock are defined, and the maximum safe catch or equilibrium yield is estimated. Management of the sport fishery according to equilibrium yield is discussed with reference to regulations, distribution of fishing pressure, planting, and interspecific competition.
63. CLARK, J. R., AND R. L. CLARK, EDITORS. 1964. Sea-water systems for experimental aquariums; a collection of papers. 190 pp.
- Presents a wide range of papers providing information on design, construction, and operation of experimental aquarium facilities. Discusses geography, environment, and systems. Includes a comprehensive index.
64. ALLISON, D., B. J. KALLMAN, O. B. COPE, AND C. VAN VALIN. 1964. Some chronic effects of DDT on cutthroat trout. 30 pp.
- The effects on Yellowstone Lake cutthroat trout (*Salmo clarki lewisi*) of periodic exposure to different levels of DDT in bath and in food were determined over a 20-month period involving one spawning cycle. Changes in mortality, growth rate, and reproductive potential were studied.
65. COPE, O. B. 1964. Revised bibliography on the cutthroat trout. 43 pp.
- Presents 221 abstracts of publications on the biology, culture, distribution, and management of the cutthroat trout (*Salmo clarki lewisi*).
66. BURROWS, R. E. 1964. Effects of accumulated excretory products on hatchery-reared salmonids. 12 pp.
- Studies were conducted to determine excretory products of significance in rearing ponds and possible effect of these products on fingerling chinook salmon (*Oncorhynchus tshawytscha*). Varying toxicity of ammonia solutions were correlated with pH, water temperature, and pond type.
67. THOMAS, A. E., R. E. BURROWS, AND H. H. CHENOWETH. 1964. A device for stamina measurement of fingerling salmonids. 15 pp.
- A stamina tunnel was developed to measure differences in physical performance of salmonid fingerlings. By subjecting fish samples to controlled patterns of water velocity, it has proved possible to demonstrate differences in fish stamina imparted by disease, nutrition, and environment.
68. JENKINS, R. M. 1965. Bibliography on reservoir fishery biology in North America. 57 pp.
- Subject headings are age and growth, bibliographies, diseases and parasites, food habits, harvest rates, life history and ecology, biological limnology, physicochemical limnology, management technique evaluation, methodology and technique development, population dynamics, summaries of management and research, comprehensive or general fishery surveys, and systematics and distribution.
69. WALBURG, C. H., AND W. R. NELSON. 1966. Carp, river carpsucker, smallmouth buffalo, and bigmouth buffalo in Lewis and Clark Lake, Missouri River. 30 pp.
- Studies of age composition, growth, length-weight relation, reproduction, year-class strength, and food habits were conducted from 1962 to 1964 on common carp (*Cyprinus carpio*), river carpsucker (*Carpodes carpio*), smallmouth buffalo (*Ictiobus bubalus*), and bigmouth buffalo (*I. cyprinellus*) in Lewis and Clark Lake, a main stem Missouri River reservoir impounded in July 1955.
70. HALVER, J. E., AND I. A. MITCHELL, EDITORS. 1967. Trout hepatoma research conference papers. 199 pp.
- Reviews the status of rainbow trout (*Salmo gairdneri*) hepatoma, relates discussions at the conference between major active research groups, and projects future research programs.
71. BENSON, N. G. 1968. Review of fishery studies on Missouri River main stem reservoirs. 61 pp.
- The six main stem Missouri River reservoirs are described, and information available through 1964 on plankton, water chemistry, fish populations, and water management is discussed. Available information on growth rates, year-class strength, and relative abundance of common species is described. Research needs and problems relative to fish production are discussed.
72. HUNN, J. B. 1967. Bibliography on the blood chemistry of fishes. 32 pp.

73. HOBSON, E. S. 1968. Predatory behavior of some shore fishes in the Gulf of California. 92 pp.
Predatory behavior in some Gulf of California shore fishes was studied to define certain general activity patterns. Between 1962 and 1965 over 1,200 hours of underwater observations were made at all hours of day and night. Predatory activity in 46 species was observed, and supplemental data were obtained on many others. Digestive-tract contents from 716 specimens were analyzed.
74. APPLGATE, R. L., AND J. W. MULLAN. 1969. Ecology of daphnia in Bull Shoals Reservoir. 23 pp.
Life histories of *Daphnia galeata mendotae*, *D. retrocurva*, *D. parvula*, *D. ambigua*, and *D. schodleri* are compared with year-class strength and food of threadfin shad (*Dorosoma petenense*) in Bull Shoals Reservoir from 1965 to 1967.
75. SMITH, W. G., AND M. P. FAHAY. 1970. Description of eggs and larvae of the summer flounder, *Paralichthys dentatus*. 21 pp.
Summer flounder eggs and larvae are described from artificially fertilized specimens and from material collected at sea.
76. EVANS, D. H., AND P. G. WARES. 1972. Food habits of striped marlin and sailfish off Mexico and southern California. 10 pp.
Stomach contents of 924 striped marlin (*Tetrapturus audax*) landed in sport catches at Mazatlán, Sinaloa, and Buena Vista, Baja California Sur, Mexico; and San Diego, California; and of 197 sailfish (*Istiophorus platypterus*) from Mazatlán and Buena Vista were examined and described.
77. EDMUNDS, P. H. 1972. Genic polymorphism of blood proteins from white marlin. 15 pp.
Over 100 white marlin (*Tetrapturus albidus*) were analyzed for each of seven proteins to discover genetically controlled variations that may be useful in subpopulation studies.
78. WELLS, L., AND R. HOUSE. 1974. Life history of the spottail shiner (*Notropis hudsonius*) in southeastern Lake Michigan, the Kalamazoo River, and western Lake Erie. 10 pp.
Discusses age structure of populations, growth, weight, length, maturity, spawning season, and reproductive potential.
79. WALBURG, C. H. 1976. Changes in the fish population of Lewis and Clark Lake, 1956-74, and their relation to water management and the environment. 34 pp.
Discusses the effects of impoundment, water levels, water exchange times, shoreline erosion, and silt deposition on fish populations. Suggests improved management methods.
80. BENSON, N. G. 1980. Effects of post-impoundment shore modifications on fish populations in Missouri River reservoirs. 32 pp.
Describes post-impoundment shore modifications, including decreasing shore-length, bank-cutting, and sediment deposition, and shoreline vegetation changes. Lists fish species affected by these changes and discusses how they are affected.